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# Potential of remotely-sensed data for mapping sediment connectivity pathways and their seasonal changes in dryland environments

Saskia Foerster (1), Charlotte Wilczok (2), Arlena Brosinsky (1,2), Anja Kroll (2), Karl Segl (1), and Till Francke (2)

(1) Remote Sensing section, GFZ German Research Centre for Geosciences, Potsdam, Germany, (2) Institute of Earth and Environmental Science, University of Potsdam, Potsdam, Germany

Many drylands are characterized by strong erosion in headwater catchments, where connectivity processes play an important role in the redistribution of water and sediments. Sediment connectivity relates to the physical transfer of sediment through a drainage basin (Bracken and Croke 2007). The identification of sediment source areas and the way they connect to the channel network are essential to environmental management (Reid et al. 2007), especially where high erosion and sediment delivery rates occur. Vegetation cover and its spatial and temporal pattern is one of the main factors affecting sediment connectivity. This is particularly true for patchy vegetation covers typical for dryland environments.

While many connectivity studies are based on field-derived data, the potential of remotely-sensed data for sediment connectivity analyses has not yet been fully exploited. Recent advances in remote sensing allow for quantitative, spatially explicit, catchment-wide derivation of surface information to be used in connectivity analyses. These advances include a continuous increase in spatial image resolution to comprise processes at the plot to hillslope to catchment scale, an increase in the temporal resolution to cover seasonal and long-term changes and an increase in the spectral resolution enabling the discrimination of dry and green vegetation fractions from soil surfaces in heterogeneous dryland landscapes.

The utilization of remotely-sensed data for connectivity studies raises questions on what type of information is required, how scale of sediment flux and image resolution match, how the connectivity information can be incorporated into water and sediment transport models and how this improves model predictions. The objective of this study is to demonstrate the potential of remotely-sensed data for mapping sediment connectivity pathways and their seasonal change at the example of a mesoscale dryland catchment in the Spanish Pyrenees. Here, sediment connectivity pathways have been mapped for two adjacent sub-catchments (approx. 70 $km^2$) of the Isábena River in different seasons using a quantitative connectivity index based on fractional vegetation cover and topography data. Fractional cover of green and dry vegetation, bare soil and rock were derived by applying a Multiple Endmember Spectral Mixture Analysis approach applied to a hyperspectral image dataset. Sediment connectivity was mapped using the Index of Connectivity (Borselli et al. 2008), in which the effect of land cover on runoff and sediment fluxes is expressed by a spatially distributed weighing factor (in this study, the cover and management factor of the RUSLE).

The resulting connectivity maps show that areas behave very differently with regard to connectivity, depending on the land cover but also on the spatial distribution of vegetation abundances and topographic barriers. Most parts of the catchment show higher connectivity values in summer than in spring. The studied sub-catchments show a slightly different connectivity behaviour reflecting the different land cover proportions and their spatial configuration. Future work includes the incorporation of sediment connectivity information into a hydrological model (WASA-SED, Mueller et al. 2010) to better reflect connectivity processes and testing the sensitivity of the model to different input data.